

CLAIMS

1. A method for changing a frequency in a radio optical fusion communication system including a base station and a remote antenna station, the base station generating a modulated radio signal, electro-optically converting the generated signal into an optical signal while the modulation mode is kept, and transmitting the converted signal to the remote antenna station over an optical fiber path, the remote antenna station opto-electrically converting the received optical signal to extract the modulated radio signal and transmitting the signal through an antenna by radio, the base station including a first light source and a second light source for generating optical signals of different frequencies, an intermediate-frequency signal generating means for generating a modulating signal at an intermediate frequency band, a modulator for modulating the optical signal from the first light source into an unsuppressed-carrier single-sideband (SSB) or double-sideband (DSB) modulated optical signal using the intermediate-frequency signal, and an optical mixer for mixing the modulated optical signal with the optical signal from the second light source to obtain an optical transmission signal, the method comprising the step of: controlling the frequency of at least one of the optical signals from the first and second light sources so that the

difference in frequency between the optical signals is a desired frequency of the modulated radio signal, thereby being switched the frequency channel of the modulated radio signal extracted by the remote antenna station.

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2. The method for changing a frequency in the radio optical fusion communication system according to Claim 1, wherein the frequency of the optical signal from at least one of the first and second light sources is shifted through
10 an optical frequency shifter provided downstream of the light source.

3. The method for changing a frequency in the radio optical fusion communication system according to Claim 2,
15 wherein the optical frequency shifter has optical waveguides including a main Mach-Zehnder integrated with two sub Mach-Zehnders, the optical frequency shifter is driven in accordance with a predetermined frequency oscillation signal for determination of the amount of frequency shift, and the
20 frequency is shifted as much as the frequency of the oscillation signal by changing a voltage applied to the optical frequency shifter such that the optical waveguides have predetermined phase differences therebetween.

25 4. The method for changing a frequency in the radio

optical fusion communication system according to Claim 3,
wherein the predetermined phase difference between the
waveguides in each sub Mach-Zehnder is set to $+\pi$ or $-\pi$, a
voltage is applied such that the predetermined phase
5 difference between the waveguides in the main Mach-Zehnder
is reversed between $+\pi/2$ and $-\pi/2$, and the frequency of the
optical signal from the light source is shifted in each of
upper and lower sidebands as much as the predetermined
frequency to obtain the amount of frequency shift that is
10 twice as much as the predetermined frequency.

5. The method for changing a frequency in the radio
optical fusion communication system according to Claim 3,
wherein the predetermined phase difference between the
15 waveguides in the main Mach-Zehnder is set to $+\pi/2$ or $-\pi/2$,
a voltage is applied such that the predetermined phase
difference between the waveguides in each sub Mach-Zehnder
is reversed between $+\pi$ and $-\pi$, and the frequency of the
optical signal from the light source is shifted in each of
20 upper and lower sidebands as much as the predetermined
frequency to obtain the amount of frequency shift that is
twice as much as the predetermined frequency.

6. The method for changing a frequency in the radio
25 optical fusion communication system according to any one of

Claims 3 to 5, wherein the applied voltage includes a pulse train having a predetermined pulse frequency, pulse pattern, and pulse voltage to hop the frequency of the modulated radio signal.

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7. The method for changing a frequency in the radio optical fusion communication system according to any one of Claims 3 to 5, wherein the predetermined frequency oscillation signal for determination of the amount of frequency shift is hopped to hop the frequency of the modulated radio signal.

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8. A base station in a radio optical fusion communication system that includes the base station and a remote antenna station, the base station generating a modulated radio signal, electro-optically converting the generated signal into an optical signal while the modulation mode is kept, and transmitting the converted signal to the remote antenna station over an optical fiber path, the remote antenna station opto-electrically converting the received optical signal to extract the modulated radio signal and transmitting the signal through an antenna by radio, the base station comprising: a first light source and a second light source for generating optical signals of different frequencies; an intermediate-frequency signal

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generating means for generating a modulating signal at an intermediate frequency band; a modulator for modulating the optical signal from the first light source into an unsuppressed-carrier single-sideband (SSB) or double-sideband (DSB) modulated optical signal using the intermediate-frequency signal; an optical mixer for mixing the modulated optical signal with the optical signal from the second light source to obtain an optical transmission signal; and control means capable of controlling the frequency of at least one of the optical signals from the first and second light sources so that the difference in frequency between the optical signals is a desired frequency of the modulated radio signal.

9. The base station in the radio optical fusion communication system according to Claim 8, further comprising: an optical frequency shifter, provided downstream of at least one of the first and second light sources, for shifting the frequency of the optical signal from the light source.

10. The base station in the radio optical fusion communication system according to Claim 9, wherein the optical frequency shifter has optical waveguides including a main Mach-Zehnder integrated with two sub Mach-Zehnders,

each sub Mach-Zehnder includes an electrode which is supplied predetermined oscillation signal and voltage for determination of the amount of frequency shift, the main Mach-Zehnder includes an electrode which is supplied predetermined voltage, the optical frequency shifter is driven in accordance with a predetermined frequency oscillation signal for determination of the amount of frequency shift, and the frequency is shifted as much as the frequency of the oscillation signal by changing a voltage applied to the optical frequency shifter such that the optical waveguides have predetermined phase differences therebetween.

11. The base station in the radio optical fusion communication system according to Claim 10, wherein the predetermined phase difference between the waveguides in each sub Mach-Zehnder is set to $+\pi$ or $-\pi$, a voltage is applied such that the predetermined phase difference between the waveguides in the main Mach-Zehnder is reversed between $+\pi/2$ and $-\pi/2$, and the frequency of the optical signal from the light source is shifted in each of upper and lower sidebands as much as the predetermined frequency to obtain the amount of frequency shift that is twice as much as the predetermined frequency.

12. The base station in the radio optical fusion communication system according to Claim 10, wherein the predetermined phase difference between the waveguides in the main Mach-Zehnder is set to $+\pi/2$ or $-\pi/2$, a voltage is
5 applied such that the predetermined phase difference between the waveguides in each sub Mach-Zehnder is reversed between $+\pi$ and $-\pi$, and the frequency of the optical signal from the light source is shifted in each of upper and lower sidebands as much as the predetermined frequency to obtain the amount
10 of frequency shift that is twice as much as the predetermined frequency.

13. The base station in the radio optical fusion communication system according to any one of Claims 10 to 12,
15 wherein the applied voltage includes a pulse train having a predetermined pulse frequency, pulse pattern, and pulse voltage to hop the frequency of the modulated radio signal.

14. The base station in the radio optical fusion
20 communication system according to any one of Claims 10 to 12, wherein the predetermined frequency oscillation signal for determination of the amount of frequency shift is hopped to hop the frequency of the modulated radio signal.